

DEPARTMENT OF ENERGY	LESSON PLAN
	<p>Course: Radiological Control Technician</p> <p>Unit: Site Academics</p> <p>Lesson: 2.13 Radiological Incidents and Emergencies</p>
<p>Learning Objectives:</p> <p>2.13.01 Describe the general response and responsibilities of an RCT during any incident.</p> <p>☞ 2.13.02 Identify any emergency equipment and facilities that are available, including the location and contents of emergency equipment kits.</p> <p>☞ 2.13.03 Describe the RCT response to a Continuous Air Monitor (CAM) alarm.</p> <p>☞ 2.13.04 Describe the RCT response to a personnel contamination monitor alarm.</p> <p>☞ 2.13.05 Describe the RCT response to off scale or lost dosimetry.</p> <p>☞ 2.13.06 Describe the RCT response to rapidly increasing, unanticipated radiation levels or an area radiation monitor alarm.</p> <p>☞ 2.13.07 Describe the RCT response to a dry or liquid radioactive material spill.</p> <p>☞ 2.13.08 Describe the RCT response to a fire in a radiological area or involving radioactive materials.</p> <p>☞ 2.13.09 Describe the RCT response to other specific site incidents (as applicable).</p> <p>☞ 2.13.10 Describe the response levels associated with radiological emergencies.</p> <p>☞ 2.13.11 Describe site specific procedures for documenting radiological incidents.</p> <p>☞ 2.13.12 Identify the structure of the emergency response organization at your site.</p> <p>☞ 2.13.13 Identify the available offsite incident support groups and explain the assistance that each group can provide.</p> <p>☞ 2.13.14 Discuss radiological incidents at the plant or other plants, including cause, prevention, and recommended incident response.</p>	
References: (Site specific emergency preparedness manuals)	
Instructional Aides: Overhead projector/screen, chalkboard/whiteboard	

I. LESSON INTRODUCTION**A. Self Introduction**

1. Name
2. Phone number
3. Background

B. Motivation

State that most people have an attitude that "it can't happen here" and don't take incident response planning seriously. Explain that incidents do occur, and experience has shown that best response comes from workers who have prepared themselves with a plan for dealing with incidents. Relate to a car skidding on ice. If the driver has thought about corrective actions for skidding, he will be less likely to panic. State that no plan can give an exact solution to every problem, but that a step-by-step approach to responding to any problem can be used.

C. Lessons Overview

1. Radiological incidents
2. Response to incidents
3. Response to emergencies or potential emergencies
4. Radiological emergencies Planning and organizations

D. Introduce Objectives

Show O.H.: Objectives

II. LESSON OUTLINE

NOTE: This lesson plan should be developed using site specific information and regulatory documents. The following is a recommended format of material.

A. RADIOLOGICAL INCIDENTS

1. Definition

Ask the student to define in their own words what an incident is. Modify their answer and write the correct definition on the board.

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- Unplanned event involving radiation or radioactive materials
- Response governed by normal procedures

2. Causes

Ask the student for causes of incidents. list these on the board.

- Ignorance
- Forgetfulness
- Oversight
- Unforeseen circumstances
- Communications failures
- Mechanical failures
- Human error
- Natural disasters

3. Examples

Ask the student for examples of potential incidents at the site. List these on the board and relate to causes.

(Insert site specific information here)

Ensure that all of the basic incident types described in the site accident analysis are included in the discussion.

- a. Ignorance - Inexperienced operator not knowing correct procedure and opens the wrong valve.
- b. Oversight - Misreading an indicator and allowing a valve to be opened.
- c. Mechanical Failure - Instrument line ruptures causing spread of contamination.

For each general type of accident:

- Discuss expected radiation levels and/or types and quantities of isotopes released
- Discuss on site consequences
- Discuss off site consequences

- Ask the student for examples of how human error or violating procedures could result in the consequences of the incident being greater than presented in the site accident analysis.

4. Non-radiological risks

Explain that immediate threats to life and health, such as fire, may require disregarding normal procedures, but that ALARA can always be applied if not following normal procedures.

B. GENERAL RESPONSE TO INCIDENTS

Objective 2.13.01

1. Although radiological control personnel respond to an emergency using basic guidelines, an area or site may have specific procedures which have priority over these guidelines.
2. Radiological control personnel must be familiar with the emergency procedures applicable to each site and the types of equipment to which they are assigned. The basic guidelines can then be used in conjunction with the specific procedures. In addition, the order or necessity of some actions may change depending on whether one is the first responder, one of many responders, or a backup person.
3. The basic emergency response guidelines are:
 - a. Define and assess the problem. The best contact is people at the scene.
 - b. Attempt to stop the cause of the emergency. No undue risks should be taken.

Depending on the nature of the incident, do not delay or over analyze the situation. Assess only what is needed for action.

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|--|---|
| c. Notify site management and safety. | Whether or not to activate a site emergency response program (such as dialing 911) is determined by the nature of the incident. Activation usually automatically fulfills this requirement. When a situation is confusing, not fully understood, or may not be controllable; over reacting is better than under reacting. |
| d. Warn personnel in the area of the emergency. This keeps unnecessary personnel away from the event site, minimizing their exposure. | |
| e. Isolate the area. Install barriers as quickly as possible to establish an exclusion area. The exclusion area may be very large initially. In determining the size of the exclusion area, consider the gamma dose rate, potential for criticality, possible spread of radioactive contamination or other hazardous materials, weather conditions, non-radiological hazards, and security (site security may assist in establishing boundaries). Outside the exclusion area normal operations may continue. | Even if there is no radiological risk, an RCT may help others provide access control. |
| f. Minimize personnel exposure. For initial response, no unnecessary exposure should be taken. Plan supplementary operations as necessary to assure personnel exposure is minimized. All planned exposures above the occupational limits is voluntary. | |
| g. Secure ventilation. Close entrances, windows, and the supply ventilation systems as necessary. | Unless one is certain that ventilation is contributing to the incident, this may involve no more than just ensuring that conditions are correct for normal designed ventilation. |

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- h. Perform surveys. Radiological control personnel are trained to perform emergency surveys. Types of surveys will vary with the nature of the emergency.
- i. Initiate the recovery. This includes clean-up operations, decontamination and moving the exclusion area barricade inward.

Performing good surveys may require significant time but must be done before recovery can be initiated.

C. FACILITIES AND EQUIPMENT

(Insert site specific information here)

Objective 2.13.02

RCT's should always know the resources and equipment available to them in the area where they are working. For each site or area, discuss the location, security and habitability provisions, equipment and communications available.

- Staging Areas
- Emergency Cabinets

D. RESPONSE TO CONTINUOUS AIR MONITOR (CAM) ALARM

(Insert site specific information here)

Objective 2.13.03

Explain the basis for and significance of the alarm setpoints for CAMs at your site.

1. Radiological control personnel shall report to the area where personnel have evacuated and survey all affected personnel.
2. Personnel should be interviewed for information on any off-normal event which could have caused the alarm.
3. Re-entry into event area to evaluate the nature of the alarm is considered an emergency response. Proper protective clothing and respiratory equipment should be worn.

**E. RESPONSE TO PERSONNEL CONTAMINATION
MONITOR ALARM**

Objective 2.13.04

(Insert site specific information here)

1. Radiological control personnel shall report to the scene with at least portable instruments for direct surveys and smear media.
2. Affected worker shall remain in the area.
3. The RCT should perform whole body surveys (frisk) for both alpha and beta-gamma in addition to the specific area of the person causing alarm.
4. Suspect an up-take if contamination is verified and survey facial area for contamination, taking nasal smears or nose blows. If positive, contact RC supervision and medical before releasing personnel.
5. The RCT should take actions to minimize cross-contamination, such as putting a glove on a contaminated hand, especially when moving or transporting personnel.
6. Document all surveys and estimate skin dose on proper forms.
7. Report all confirmed skin contaminations to HP supervision and to medical personnel if transporting to medical facility.
8. Gather appropriate information for follow-up surveys.
9. Follow-up actions shall be in accordance with the site procedure. These typically include:

The RCT should be careful not to contaminate self and instrumentation.

Do not unduly delay any decontamination efforts by taking too long in documenting contamination for skin dose estimates. Remember that dose is being incurred all the time that the skin is contaminated. Think ALARA especially in the case of high energy beta emitters.

Removal of contaminated clothing or decontamination of minor skin contamination.

Decontaminate skin using mild non-abrasive soap and tepid water or decon towelettes. Continue decon as long as significant reduction in activity is occurring after each decon. Do not irritate the skin.

Verification that personnel monitoring equipment is working properly. Equipment should not be returned to service until all problems are resolved.

Alarms can be caused by a variety of equipment failures or by "nuisance" non-work related situations such as environmental radon resulting from local conditions.

NOTE: Alarms and alarm set points should not be tampered with. If alarm cannot be silenced by the acknowledge button, take out of service.

F. RESPONSE TO OFF-SCALE OR LOST DOSIMETRY

Objective 2.13.05

(Insert site specific information here)

1. For Off-scale self reading dosimeters, typical actions include:
 - a. Assure that the worker is placed in as safe an area as possible (low dose area) and that the work has been left in a safe condition where possible.
 - b. Alert others working in the area (for off-scale response).
 - c. Evaluate the situation. All dose indicated by the dosimeter is assumed to have been received by the individual until it can be clearly demonstrated otherwise.

- d. Gather data for dose estimate if necessary.
Practice ALARA by using remote or extendable instruments to measure high level radiation fields.
For High exposures, the official permanent dosimetry (TLD or film badge) may have to be retrieved for processing.

2. For lost dosimetry, typical actions include:

- a. Individual(s) must leave the area if dosimetry is required.
- b. Contact HP supervision for reissue of dosimetry.

G. RESPONSE TO RAPIDLY INCREASING, UNANTICIPATED RADIATION LEVELS OR AN AREA RADIATION MONITOR ALARM.

Objective 2.13.06

(Insert site specific information here)

Typical actions include:

- 1. Evacuate personnel as quickly as possible to a safe area (low dose area).
- 2. Verify low dose area radiation levels are acceptable.
- 3. Evaluate the situation. The best contact is people at the scene.
- 4. Notify site management and safety.

Whether or not to activate a site emergency response program (such as dialing 911) is determined by the nature of the incident. Activation usually automatically fulfills this requirement. When a situation is confusing, not fully understood, or may not be controllable; over reacting is better than under reacting.

- 5. Re-occupy area only when radiation levels return to normal background.
- 6. Document all surveys using appropriate forms.

H. RESPONSE TO DRY OR LIQUID RADIOACTIVE SPILL

Objective 2.13.07

*(Insert site specific information here)*1. STOP the spill.

- a. Take appropriate precautions, dependent on situation, all are different.
- b. Correct immediately, if possible without undue risks.

ALARA should be practiced at all times. If a major spill can be averted with minimal risk, then some action may be warranted; otherwise, try to contain the spill as it presents itself.

2. WARN other personnel.

- a. Let people in the affected area know what is going on.
- b. If situation warrants, evacuate the area.
- c. Notify your supervisor, site management, and emergency response network if appropriate.

As before, whether or not to activate a site emergency response program (such as dialing 911) is determined by the nature of the incident. Activation usually automatically fulfills this requirement. When a situation is confusing, not fully understood, or may not be controllable; over reacting is better than under reacting.

3. ISOLATE the area.

- a. Establish boundaries around spill area for exposure and contamination control.

Use banners or whatever materials available to isolate the area. Recruit whatever personnel are at hand to assist.

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4. MINIMIZE exposure.

Use all protective gear available. Do not risk uptakes by not using respiratory protection or anti- contamination clothing.

a. To yourself as well as others.

b. Practice ALARA principles.

5. SECURE Ventilation

Unless one is certain that ventilation is contributing to the incident, this may involve no more than just ensuring that conditions are correct for normal designed ventilation.

a. Control HVAC (heating, ventilation, air conditioning).

6. Follow-up.

Major spills may very likely involve many people and require Radiation Work Permits and ALARA reviews of activities. Do not try to clean up a major spill by yourself, just keep it contained and isolated until the entire clean up operation is formulated.

a. Survey as necessary including air sampling.

b. Decontaminate as necessary.

c. Complete all documentation surveys and logs.

I. RESPONSE TO A FIRE IN A RADIOLOGICAL AREA OR INVOLVING RADIOACTIVE MATERIALS

Objective 2.13.08

(Insert site specific information here)

Typically Health Physics will supply support to the Fire Department and will be represented at the Command Post.

J. RESPONSE TO OTHER SITE SPECIFIC INCIDENTS

Objective 2.13.09

*(Insert site specific information here)***K. RESPONSE LEVELS***(Insert site specific information here)*

1. General Emergency: A response level that represents an event in progress or having occurred and that involves actual or imminent substantial reduction of site safety systems, in which offsite releases of radioactive or other hazardous substances are occurring or are expected to occur which exceed protective guidelines.
2. Site Emergency: An emergency response level which represents an event in progress or having occurred that involves actual or likely major failures of site functions that are needed for the protection of onsite personnel, the public health and safety, and the environment. Releases offsite of radioactive or other hazardous substances not exceeding protective guidelines are occurring or are likely to occur.
3. Alert: An emergency level that represents an event in progress or having occurred which involves an actual or potential substantial reduction of the level of safety of the site. Limited offsite releases of radioactive or other hazardous substances may occur but are not expected to produce negative offsite impacts.
4. Unusual Event: An emergency response level which represents an event in progress or having occurred that normally would not constitute an emergency but which indicated an potential reduction of safety of a site and in which no potential exists for significant offsite release of radioactive or other hazardous substances. Activation of offsite response organizations is not expected.

L. DOCUMENTATION OF RADIOLOGICAL INCIDENTS AND EVENT CATEGORIZATIONS

Objective 2.13.11

(Insert site specific information here)

Event Categorizations

1. Emergency: An event having significant offsite consequences or resulting in activation of the site emergency plan (i.e., activation of an Emergency Control Center).
2. Unusual Occurrence: A non-emergency that has significant impact or potential impact on health and safety, the environment, security or operations.
3. Off-Normal: Other events or conditions that adversely affect health and safety, the environment, security or site operations or which indicate that degradation in protection or performance has occurred.

M. EMERGENCY RESPONSE ORGANIZATION

(Insert site specific information here)

Objective 2.13.12

Discuss reporting and authority relationships, persons normally assigned to each team, and where they are located. Emphasize the responsibilities of RCT when assigned to applicable teams.

Emergency organization and responsibilities may include:

- Site specific teams
- Crisis Manager
- Crisis Management Team
- Operational Assistance Team
- Emergency Response Team
- First Line Initial Response Team

N. OFFSITE SUPPORT GROUPS

(Insert site specific information here)

Objective 2.13.13

For each offsite support group, discuss the training and qualifications, number of personnel, and equipment resources available.

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1. Purpose is to overcome the limitations of the lack of training and insufficient equipment/personnel.

Explain that local offsite response groups may have different dose guidelines that they have to follow. Emphasize that the most restrictive guideline must be followed for these personnel.

2. May include:

- Firefighting
- Medical
- Law enforcement

O. SITE SPECIFIC LESSONS LEARNED

(Insert site specific information here)

Objective 2.13.14

Ensure that all of the basic incident types at the site are included in the discussion.

For each of the following incidents, refer the students to the applicable site procedures listed and discuss each step.

Emphasize the rationale for the actions instead of just listing them. Include each of the following under the discussion of each incident type as applicable:

- Additional ways in which each could be discovered, such as routine surveys or observation of unusual conditions.
- Who is in charge of response
- Radiation Control responsibilities
- Immediate actions

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- Corrective actions
- Recovery
- Documentation

Read the accident reports and analysis and then:

- Discuss the radiation levels and/or types and quantities of isotopes released.
- Discuss on site consequences.
- Discuss off site consequences.

III. SUMMARY

Conduct summary by asking questions which will show that the student objectives have been met. Modify answers for completeness, correctness and clarity. Use the student objectives to formulate your questions. Base your selection of questions on the areas that the students have demonstrated some weakness or misconceptions.

A. Review major points

1. Radiological incidents
2. Response to incidents
3. Response to emergencies or potential emergencies
4. Radiological emergencies Planning and organizations

B. Review learning objectives

IV. EVALUATION

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Evaluation shall consist of a written examination comprised of multiple choice, fill-in the blank, matching and/or short answer questions. 80% shall be the minimum passing criteria for examinations.